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# A Dual band CPW Microstrip antenna for WLAN, WiMAX Applications

**Gourav Hans[1], Jaswinder Kaur[2]**

Student, Electronics and Communication Engineering Department, Thapar University, Patiala, India[1]

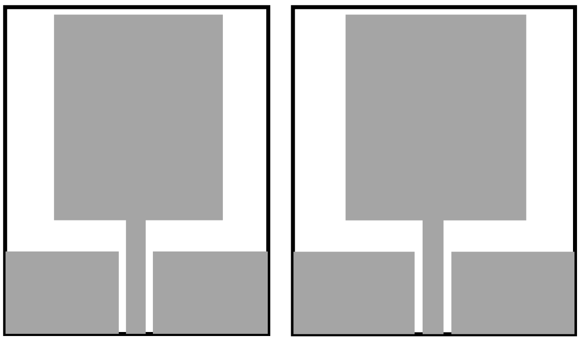
Lecturer, Electronics and Communication Engineering Department, Thapar University, Patiala, India[2]

**Abstract:** A novel dual band monopole planar antenna suitable for wireless applications has been discussed in this paper. The proposed antenna has two resonant modes which are associated with five slots which contribute the upper resonant frequency and can reduce the size of lower resonant length. The proposed antenna feed by coplanar waveguide (CPW). The antenna is simulated and the measured results show that operating band of proposed antenna cover (2.4-2.7 GHz) and (5.2-6.3 GHz) band with $S_{11}$<-10dB which can meet the requirement of WLAN, WiMAX applications along with that it provide wide frequency band, moderate gain and return loss. The simulation has been done using computer simulation technology microwave studio version [10.0] [CST MWS V 10.0]

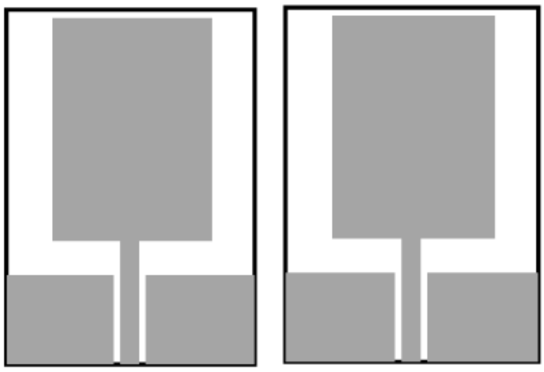
**Keywords:** Dual-band, monopole antenna, CPW, WLAN/WiMAX, Wide bandwidth

## I. INTRODUCTION

Wireless communication is continuing the witness of tremendous growth and implementation of wide variety of applications. Microstrip patch antenna is widely considered to be a suitable for many wireless applications; even though it usually has a narrow band width [1]. To meet the above requirements two individually challenging modifications may have to be combined to design a microstrip antenna with dual-frequency characteristics and wideband operation [2]. The proposed antenna has been used in WLAN and WiMAX because of some good features like low cost, low profile, easy to fabricate and nearly omni directional characteristics. The most serious limitation of microstrip antenna is narrow bandwidth. Feed line is the important component of printed antenna structure. The feed line used in proposed antenna is CPW in which microstrip antenna consist of a parallel conducting layers separating a dielectric medium referred as substrate which have a attractive feature such as wider bandwidth, better impedance matching and easy integration with active device [3]. The antenna introduced have a various resonating length and excited by CPW feed line. The dual frequency is obtained by introducing various resonating length and frequency is tuned by changing the length of slot and ground plane provide a good impedance matching which is suitable for WLAN, WiMAX Applications.



**Antenna 1** **Antenna 2**



**Antenna 3** **Antenna 4**

Fig. 1. Antenna design process

## II. ANTENNA DESIGN

In this section of antenna we modify antenna in different configuration. The Geometry of proposed antenna is shown in fig1 to obtain the dual-band characteristics we cut the different resonating length slot in patch. The dimension of antenna 20×32 mm have FR4 substrate of thickness h=1.2 mm and relative permittivity= 4.4. The gap between the feed line and the ground plane is 0.4 mm and the antenna is excited by 50 Ω CPW. The antenna is classified by four configuration of monopole antennas i.e. Antenna1, Antenna2, Antenna3, Antenna4. Antenna1 is $\lambda/2$ antenna have a radiating is larger than feed line which create a large current path and obtain lower band 3.4 GHz and wide bandwidth at upper resonant frequency now, Antenna 1 is upgrade by Antenna 2 in which we cut a three resonant length by this there is change in current path and it effect the upper band and it also decrease the bandwidth of lower and upper band but along with that it excited the unwanted resonant frequency to solve this problem Antenna3 in which we cut another slot at bottom of the patch which reduce the lower band but provide a large bandwidth at upper band and reduce some unwanted resonance . In Antenna4 we cut another slot just above the last resonating length and U shape slot at the centre of the

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upper end of radiating element which reduce the unwanted resonance and lies above $S_{11}$= -10dBi and give the wide band with at upper band on other hand adjusting the distance G from the radiating element to the ground plane can obtain good impedance matching and Gap G impact on a return loss of antenna. The final proposed antenna which is shown in Fig.2

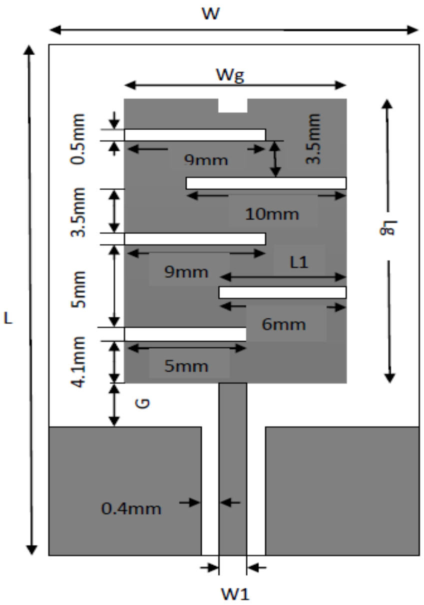


Fig. 2. Configuration of antenna 4

The parameter that used in antenna 4 is given below

| Parameter | L | W | Lg | Wg | W1 | G |
|---|---|---|---|---|---|---|
| Size (mm) | 32 | 20 | 22 | 12 | 1.65 | 2 |

## III. SIMULATED RESULTS

The proposed antenna is simulated and design with the aid of CST Microwave Studio 2010.

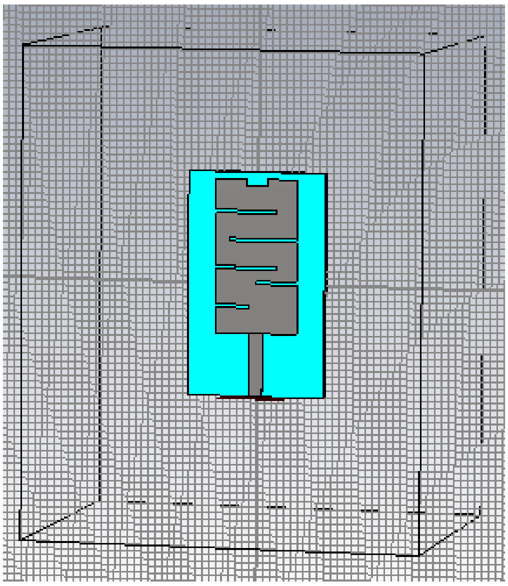

Fig. 3. Simulated design of the antenna

### A. RETURN LOSS

The return loss values obtained from various proposed antenna configuration are demonstrated in Fig. 4

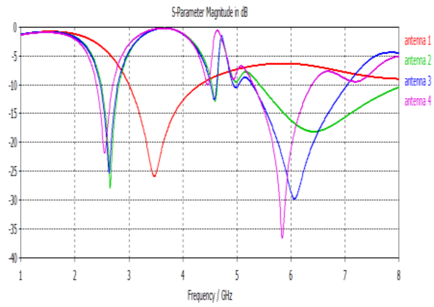


Fig. 4. Return loss of various proposed antennas

Antenna 1 resonate at frequency 3.4 GHz offer a wide bandwidth ($S_{11}$<10dB) of 1400MHz (2.9-4.3GHz) . Antenna 2 resonate a 2.6 GHz offer bandwidth of 335 MHz (2.4-2.8 GHz) and resonate frequency is shifted to lower side and bandwidth is decreases because of the width of radiating element diminished since embed the slots. Antenna 3 frequency resonate at 2.6/6.1 GHz the lower impedance bandwidth 340 MHz (2.46-2.80 GHz) and upper band which covers wide bandwidth 1768 MHz (5.2-7.0 GHz).

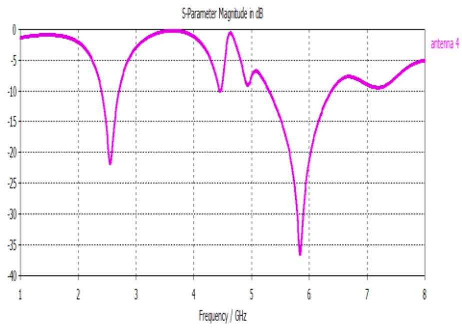


Fig. 5. Return loss of final proposed antenna 4

Antenna 4 which is finally proposed antenna in Fig.5, this slot match the impedance around the unwanted resonant that provide lower impedance bandwidth 300 MHz (2.4-2.7 GHz) and upper band width provide a bandwidth of 1009 MHz (5.2-6.3 GHz) which covers band of WiMAX, WLAN, Bluetooth according to IEEE standards along with that it remove the unwanted resonance occur in upper band.

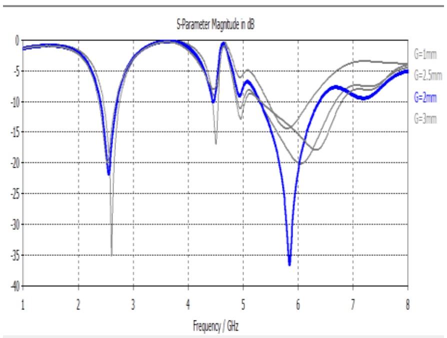


Fig. 6. Simulated return loss of antenna 4 with various dimension of G

The above figure show the return loss of Antenna 4 with various dimension of G which impact the return loss and the bandwidth at G=2 mm we get a better impedance matching, return loss and bandwidth so from this we conclude that by adjusting gap G between ground and radiating element we get a good impedance matching.

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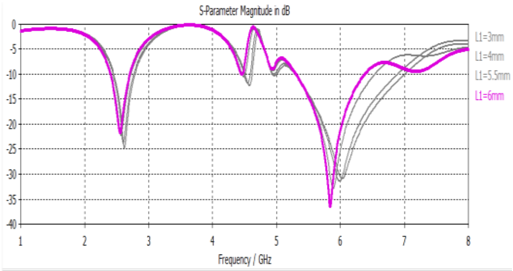

Fig. 7. Return loss of antenna 4 with various length of L1 slot

The slot “L1” impact on return loss of antenna and it also remove the unwanted resonance at upper band in Fig 7, the various length of slot at L1= 6 mm the frequency is move to lower side at upper band and have a better return loss and there is small decrease in return loss at the lower band but overall there is good impedance matching return loss and remove the unwanted resonance

*B. CURRENT DISTRIBUTION*

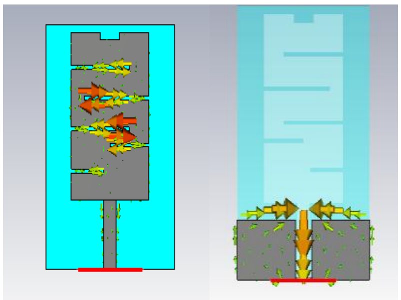
Fig. 8. Current density at 2.5 GHz

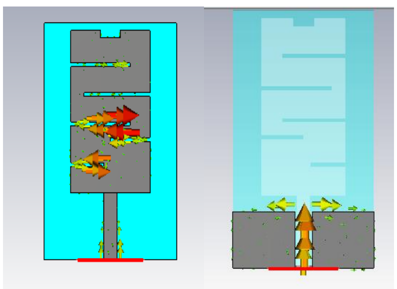
Fig. 9. Current density at 5.8 GHz

Current analysis of antenna have been shown in Fig 8 and Fig.9, which demonstrate the two resonating modes at 2.5 GHz resonating modes the current is mainly distributed on centre section of radiating element and the slot at ground effect the return loss of antenna and bandwidth at 5.8 GHz resonating mode the current density at lower section of a radiating element is more and on ground side also which gives a larger bandwidth and better return loss.

*C. VSWR*

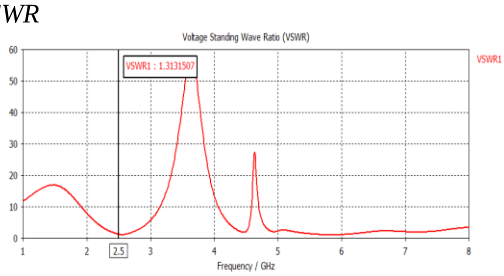

Fig. 10. Plot of VSWR vs. frequency at 2.5 GHz

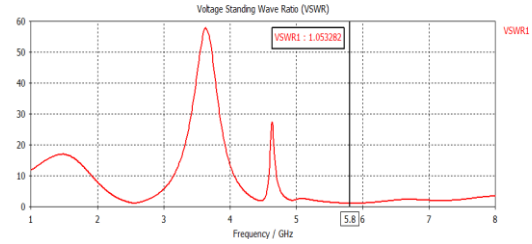

Fig. 11. Plot of VSWR vs. frequency at 5.8 GHz

The VSWR vs. Frequency graph of the proposed antenna has been shown in Fig.5 and Fig. 6 respectively which demonstrates

Fig. 11. Plot of VSWR vs frequency at 5.8 GHz
The VSWR vs. Frequency graph of the proposed antenna has been shown in Fig.10 and Fig.11 respectively which demonstrates that the VSWR value lies below 2 at both resonant frequencies as desired.

## IV. CONCLUSION

In this paper dual band antenna with CPW feeding has been suggested. The simulated antenna performance is obtained by CST Microwave Studio 2010 have been analysed. The designed of proposed antenna is compact and provide a wide bandwidth and better return loss which is suitable for WLAN, WiMAX and antenna is resonate at (2.4/5.8 GHz) with bandwidth of 300 MHz and 1009 MHZ respectively.

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